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ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Key to Small Lepidopterous Larvae in Opening Buds and New Shoots of Douglas-fir and True Firs

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Presents a key primarily for field use, emphasizing characters visible with a hand lens. The key centers on associates of the western spruce budworm, *Choristoneura occidentalis* Freeman.

Keywords: Lepidoptera, larvae, *Choristoneura occidentalis, Pseudotsuga menziesii, Abies* spp.

Field workers involved in western spruce budworm surveys or related activities often need to collect and count small larvae in opening buds and new shoots of host trees. Other foliage-feeding Lepidoptera are also found in the new growth, and it is important to be able to separate and distinguish between the various species.

This key is presented for trial use by survey, control, and research personnel working on western spruce budworm. It is based on notes prepared by the senior author during field studies on the western spruce budworm in Oregon and Washington during the period 1955-1962. We recognize that the key is not inclusive for the entire range of the western spruce budworm, but offer it for interim use while we work to develop a more comprehensive product. Many of the species covered in the key are known to be widely distributed throughout the West; therefore the key is useful to at least some degree in regions other than the Pacific Northwest.

In the 1955-1962 Oregon and Washington studies, larvae of Lepidoptera found in opening buds and expanding shoots were reared in powderboxes on host foliage. Changes in appearance following larval molts were noted, and body length during a stadium was recorded. In most cases, the actual instar is not known. Reared adults were identified by specialists at the U.S. National Museum.

This key enables workers to identify larvae by using a 10X hand lens. The key is restricted to larvae up to about 12 mm long; consequently color is emphasized as a key characteristic. Coloration and markings on the dorsal surface of the last two thoracic segments and the abdominal segments are given special attention, as are coloration and general features of the head, prothoracic shield, anal shield, and sometimes the thoracic legs. Patches of sclerotization (i.e., prespiracular sclerotization on the thorax) are used to a small extent. Many of the body features used in the key are illustrated in figure 1. Variation in color within an instar may at times be greater than indicated in the key. For example, in some localities *Griselda radicana* has a green form in most instars.

Only lepidopterous species are included in this key. Some webspinning sawflies also feed on the new growth of Douglas-fir and true firs. In Oregon, the most common of these are solitary feeders in the genus *Acantholyda*. The black or orange-brown, globose head, wrinkled appearance of the dorsum, long antennae, appendages at the rear, and lack of abdominal prolegs help to identify the group. Also, xyelid sawfly larvae, creamy-white and curled in body shape, occur at times in the center of opening buds of true firs. These are mentioned in the event they are encountered by field workers during bud or shoot examinations.

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We solicit additions to the key and comments about it, and will be actively working to provide a revised version that will give comprehensive coverage throughout the range of the western spruce budworm. Additions to the key should be in the form of authoritatively identified adults reared from larvae, the characteristics of which have been recorded using characters compatible with the key. The junior author will arrange for determinations of specimens not previously identified.

At the end of a trial period of approximately 3 years, we will revise the key and add illustrations that will further help users in picking out diagnostic characters. Please direct questions, additions, and comments to the junior author.

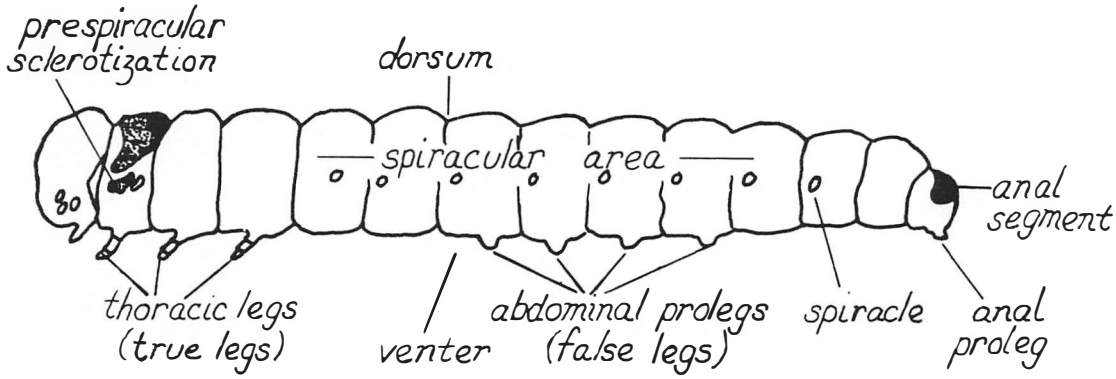
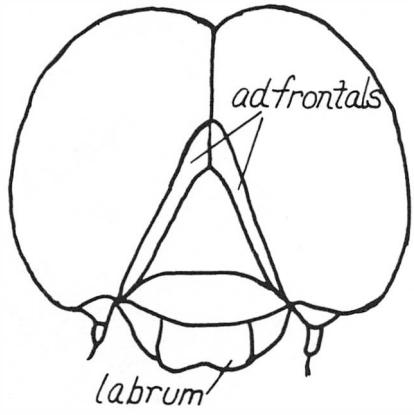
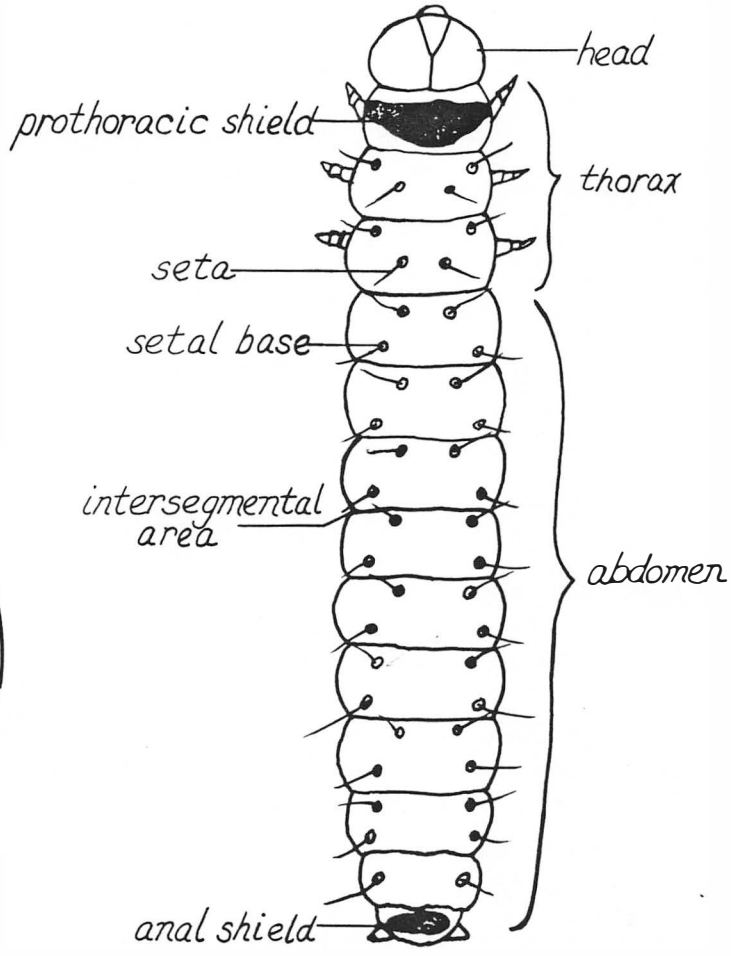


Figure 1- Larval Characters Used in Key



front view of head capsule



Key to Small Lepidopterous Larvae in Opening Buds and New Shoots of Douglas-fir and True firs

A. Larvae with two pairs of false legs, moving with an inching or looping motion based on use of anal prolegs . . . . . Section I. Geometridae

B. Larvae with five pairs of false legs, moving at a constant pace, but often wiggling violently when disturbed . . . . . Section II. Olethreutidae, Tortricidae, Gelechiidae, Pyralidae, and Noctuidae

Section I. Geometridae

1. Dorsum banded dark brown and white on first five abdominal segments, head dark brown to black. Length 4 to 7 mm . . . . . 1st instar *Lambdina fiscellaria lugubrosa*
1. Dorsum either unicolorous, or with longitudinal whitish lines 2
   2. Dorsum light or dark green, with one pair of longitudinal white lines. Length 10 mm and up to 30 mm at maturity 3
   2. Dorsum yellow to yellow-pinkish-brown, without longitudinal lines. Smaller larvae 5
3. Head pale yellow-brown; dorsum light bluish-green and lines whitish-yellow; spiracular area with a similar line and also a very thin line. Inland forests . . . . . *Enypia* sp.
3. Head green; dorsum apple green to dark green and lines white; spiracular area with a yellow line or stripe. Coastal forests 4
   4. Head green with no markings . . . . . *Melanolophia imitata*
   4. Head green with 10 black dots . . . . . *Nepytia phantasmaria*
5. Head medium to dark brown, dorsum yellowish-brown or pinkish-brown and each segment with four dark dots; spiracular area with three dark brown lines. Body 6 to 15 mm long . . . . . 2nd and 3rd instar *Lambdina fiscellaria lugubrosa*
5. Head light brown; dorsum yellow to brown; no spiracular lines 6
   6. Dorsum bright yellow, becoming pink with three longitudinal purple lines; spiracular area light brown. Body 6 to 10 mm long. Feeds under bud sheath on Douglas-fir . . . . . *Eupithecia annulata*
   6. Dorsum orange-red-brown, with yellow spiracular area and venter; body 10 mm and longer. Open feeder . . . . . *Stenoporpia* sp.

Section II. Olethreutidae, Tortricidae, Gelechiidae, Pyralidae, and Noctuidae

1. Dorsum marked with longitudinal lines; setal bases conspicuous only in *Achytonix* and *Xylomyges* (Noctuidae) 16
1. Dorsum unicolorous; setal bases often a lighter or darker color, causing a slightly spotted or spiny appearance 2
   2. Dorsum yellow-green, bright green, or olive green 14
   2. Dorsum not green, but sometimes with a faint greenish tinge 3
3. Head and prothoracic shield yellow, yellow-brown, light brown, or chestnut brown 12
3. Head dark brown to black; prothoracic shield brown to black; anal shield conspicuous, light brown to black 4
   4. Dorsum orange-brown or olive brown 5
   4. Dorsum yellow, dirty white to light brown, or cinnamon brown 7
5. Prothoracic shield light to medium brown; prespiracular sclerotization light to medium brown; anal shield light brown. Body orange-brown, 5 to 7 mm long (3d instar), or light olive brown, 6 to 10 mm long (early 4th instar) . . . . . *Choristoneura occidentalis*
5. Prothoracic shield, setal areas, and anal shield dark brown to black 6
   6. Dorsum dark olive brown with yellowish-brown in intersegmental areas; setal areas raised; anal shield dark brown, orbicular, body 4 to 5 mm long . . . . . *Achytonix epipaschiax*
   6. Dorsum light orange-brown, sometimes with greenish tinge; setal areas not raised; anal shield black, occupying most of anal segment; body 4 to 7 mm long . . . . . *Xylomyges simplex*
7. Dorsum pale yellow to lemon yellow 9
7. Dorsum dirty white to cinnamon brown 8
   8. Dorsum dirty white to light brown; head dark brown and wider than long; prothoracic shield chestnut brown; setal bases dark; anal shield large, dark brown; penultimate abdominal segment with spots of sclerotization; body 6 to 8 mm long . . . . . *Zeiraphera hesperiana*
   8. Dorsum cinnamon brown; head and prothoracic shield black; setal bases pale; anal shield large, pale ivory; body 6 to 12 mm long . . . . . 4th instar *Choristoneura occidentalis*
9. Prothoracic shield and thoracic legs dark brown to black; setal areas inconspicuous 11
9. Prothoracic shield and thoracic legs medium brown; anal shield visible 10
   10. Anal shield dark brown and orbicular, body form slender, 3 to 5 mm long . . . . . *Griselda radicana*
   10. Anal shield outlined on edges by dots of sclerotization; thoracic legs annulated brown and white; setal areas visible; body form moderately stout, body 3 to 5 mm long . . . . . 3rd instar *Choristoneura viridis*
11. Head, prothoracic shield, prespiracular sclerotization, and outside of thoracic legs jet black; anal shield medium brown and oribicular; body 3 to 8 mm long . . . . . *Acleris gloverana*
11. Head black; prothoracic shield and prespiracular sclerotization dark brown; thoracic legs annulated dark brown and white; anal shield represented by a few dots of sclerotization; body 5 to 8 mm long . . . . . 4th instar *Choristoneura viridis*
   12. Head and prothoracic shield chestnut brown, head narrower than body; dorsum pinkish-brown,

yellowish-brown, or cinnamon brown; setal bases prominent; anal shield semicircular, pale chestnut brown and occupying most of segment, body slender, 5 to 7 mm long ..... *Coleotechnites* sp.

12. Head yellow to yellow-brown; dorsum yellow-brown to yellow-green; setal bases and anal shield inconspicuous 13

13. Head as wide as body, wider than long, yellow-brown to pale chestnut brown; anal segment long, yellow, with small shield; body 6 to 8 mm long ..... *Griselda radicana*

13. Head narrower than body, longer than wide; prothoracic shield yellow-brown; anal segment of moderate length, shield inconspicuous, body 4 to 7 mm long ..... *Argyrotaenia dorsalana*

14. Head green with yellow-brown tinging around labrum and adfrontals; thorax, thoracic legs, and abdomen emerald green; body 8 to 12 mm long ..... *Argyrotaenia provana*

14. Head brown to black; body pale yellow-green; body 8 to 10 mm long 15

15. Head, prothoracic shield, and anal shield yellow-brown to pale chestnut brown, with fine black markings in center rear of prothoracic shield; anal shield orbicular ..... *Argyrotaenia dorsalana*

15. Head and thoracic legs dark brown to black; prothoracic shield paler; anal shield inconspicuous ..... *Acleris gloverana*

16. Dorsum reddish-brown or brownish-gray, with 8 to 10 interrupted white longitudinal lines; a large white eyespot around lateral seta on 8th abdominal segment ..... *Dioryctria reniculelloides*

16. Dorsum yellow, greenish-brown, or pale brown; longitudinal lines of various number and color; no eyespot on abdomen 17

17. Dorsum yellow with three orange-brown longitudinal lines; head almost as wide as body and light brown; prothoracic shield light brown; body 8 to 10 mm long ..... *Griselda radicana*

17. Dorsum brownish, greenish-brown, green, or gray-brown 18

18. Dorsum pale brown, reddish-brown, or brownish-gray, with purplish or lavender longitudinal lines; head narrower than body; body form slender ... 21

18. Dorsum green or brownish-green with one or more white longitudinal lines; a yellowish-white stripe in spiracular area; head as wide or almost as wide as body; body form stout 19

19. Dorsum pale olive green with a narrow central white line; head jet black; prothoracic and anal shields dark brown; setal areas dark brown; body 5 to 7 mm long ..... *Achytonix epipaschia*

19. Dorsum variously colored, with three rather broad white longitudinal lines 20

20. Dorsum greenish-brown; head, prothoracic shield, and setal areas black; anal shield dark brown; body 8 to 10 mm long ..... *Xylomyges simplex*

20. Dorsum apple green; head pale yellow-green; prothoracic and anal shields not evident, covered with striping; body 7 to 10 mm long ..... *Achytonix epipaschia*

21. Dorsum pale brown, with 3 to 5 reddish-purple longitudinal lines ..... *Chionodes* spp.

21. Dorsum pale yellow or pale gray with 7 to 9 fine brown-to-lavender lines; often in staminate flowers ..... *Telphusa* sp.

canusa

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long

Western Spruce Budworm ------ Larval Instars

Instar No.

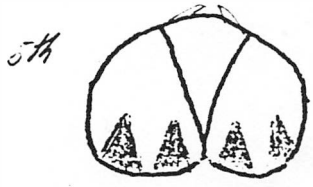
1 * Body pale green
Headcapsule tan .26 mm.

2 Body light tan
Headcapsule brown .31 mm.
Thoracic shield tan - brown
* with caudal edge rough appearing

3 Body tan - brownish
* Headcapsule blackish .49 mm.
Thoracic shield blackish and
smooth on the caudal edge

4 Body generally brownish with
* characteristic speckeled appearance
showing up. (not consistent)
Head black .80 mm.
Thoracic shield black and smooth

5 Body greenish - dark brown
speckeled
Headcapsule tan with characteristic
* dark brown - black triangular marks
originating on caudal edge
Headcapsule 1.30 mm.
Thoracic shield dark and smooth



6 Body greenish - dark brown
speckeled
* Head capsule uniform tan 2.1 mm.
Thoracic shield dark and smooth

* best general character once you know it is a WSBW

Headcapsule measurement is a mean around which
there is a range